

Appln No. 10/020,506
Amdt date September 15, 2003
Proposed Reply to Office action of July 15, 2003

REMARKS/ARGUMENTS

Executive summary

The following remarks are responsive to the Office action mailed July 15, 2003. Applicants submit that the majority of the rejections made in the Office action are based upon a belief that the limitation "at least one electrical connection exists between the carbon containing layer and the electronic device" is not supported by the specification. Applicants strenuously urge that one of ordinary skill in the art would find clear support for this limitation in the discussion of the many embodiments of the claimed invention disclosed in the specification of the above referenced application. In addition, the prior art cited in the prosecution of the above referenced application does not teach this limitation or the inventive combinations of claims 56 - 71. Therefore, applicants submit that all claims should be allowed.

Summary of Office action

Claims 56 - 71 are currently pending in the above referenced application. In the Office action, the following rejections were made:

- all claims were rejected under 35 U.S.C. §112 on the basis that "the specification does not describe an electronic device having an electrically connection between the carbon containing layer and the electronic device."
- claim 70 was also rejected under 35 U.S.C. §112 on the basis that the recitations in the claim "related to 'circuit traces' and 'a trace on the layer of electrically conductive material' were also not supported and described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the

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time the application was filed, had possession of the claimed invention."

- claims 56-61, 64-68 and 71 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent 4,888,247 to Zweben et al. (the Zweben et al. patent);
- claim 62 was rejected under 35 U.S.C. §103(a) as being obvious in light of the Zweben et al. patent; and
- claim 63 was rejected under 35 U.S.C. §103(a) as being unpatentable over Zweben et al. in view of U.S. Patent 5,326,636 to Durand et al.

Response to rejection under 35 U.S.C. §112.

Applicants admit being surprised to learn of the 35 U.S.C. §112 rejection in the Office action dated July 15, 2003. Applicants believe that the specification of the above referenced application explicitly teaches:

A printed wiring board on which an electronic device is mounted, comprising:

at least one carbon containing layer; and
wherein at least one electrical connection exists between the carbon containing layer and the electronic device.

Summary of 35 U.S.C. §112 support.

The basis of Applicants' belief that the currently pending claims satisfy 35 U.S.C. §112 is based on the following teachings from the specification of the application (each teaching is addressed in detail below):

1. the specification explicitly teaches that electrical connections can exist between electronic devices and the functional layers of a printed circuit board;

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2. the specification explicitly teaches printed wiring boards that include "at least one carbon containing layer";
3. the specification explicitly teaches that the "at least one carbon containing layer" in the printed wiring board acts as a functional layer within the printed circuit board; and
4. the specification explicitly teaches that connections can be made with the "at least one carbon containing layer" using holes lined with electrically conductive material.

Applicants submit that these teachings place one of ordinary skill in the art in possession of all elements of the claimed inventions. In particular, the teachings that electrical connections can exist between electronic devices and the functional layer of a printed wiring board, and the teaching that the "at least one carbon containing layer" can act as a functional layer, inform one of ordinary skill of the limitation that "at least one electrical connection exists between the carbon containing layer and the electronic device."

Identification of specific teachings

1. Introduction to term usage by those of ordinary skill in the art

Several terms that are readily understood by one of ordinary skill in the art such as "functional layer," "ground plane" and "power plane" are used in the specification of the above referenced application. Before discussing the teachings in the specification that use these terms, applicants will review the structures that these terms are used to describe by those of ordinary skill in the art.

One of ordinary skill in the art appreciates that printed wiring boards typically comprise a number of electrically conductive layers that are separated by layers of a dielectric

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material and would refer to the electrically conductive layers as the "functional layers" of the printed wiring board, because they perform the "functions" of the printed wiring board. One of ordinary skill in the art would also appreciate that the "functions" performed by a printed wiring board can include establishing electrical connections between electronic devices and providing power and reference signals to electronic devices.

The "functional layers" can perform the function of providing a power or reference signal to an electronic device by acting as a power or ground plane in the printed wiring board. One of ordinary skill in the art knows that a power plane is usually connected to a power supply and provides power to electronic devices via additional connections. The ground plane is typically connected to a reference voltage and uses connections to provide a stable reference voltage to electronic devices. We now consider the teachings of the specification in light of the understood usage of these terms.

2. Electrical connections can exist between electronic devices and the functional layer of the printed circuit board

Applicants submit that the specification of the above referenced application explicitly teaches the fact, which would be otherwise readily known to one of ordinary skill in the art, that electronic connections can exist between the functional layers of a printed wiring board and electronic devices. The very first line of the specification states that "Multiple-layer printed circuit boards or printed wiring boards (PWBs) are used for mounting integrated circuits (ICs) and other components" (Pg. 1, Lines 17 - 18). In addition to this statement, two U.S. Patents incorporated by reference into the specification (Pg. 2 Lines 13 - 14) disclose the mounting and connection of electronic devices such as integrated circuits onto a printed wiring board.

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Specifically, Figure 3 of U.S. Patent 4,318,954 to Jensen shows an electronic device connected to the functional layers of a printed wiring board and Figure 1 of U.S. Patent 4,591,659 to Leibowitz shows the connection of electronic devices mounted in chip carriers to circuits on the functional layers of a printed wiring board.

3. Printed wiring boards that include "at least one carbon containing layer"

Applicants submit that FIG. 1 of the above referenced application is just one of the many disclosed embodiments of the claimed inventions that include "at least one carbon containing layer" (Pg. 5, lines 17 - 21).

4. Carbon containing layers as functional layers

Applicants submit that the laminate 12 illustrated in FIG. 1 is one example in the specification of where a carbon containing layer, either alone or in combination with other layers that are electrically connected to the carbon containing layer, forms a ground or power plane or acts as both the ground and power plane in a printed wiring board. The specification teaches (Pg. 5 lines 18 - 20 and Pg. 6, lines 7 - 9):

The PWB 10 includes a laminate 12 comprising a carbon containing layer 14 sandwiched between a first layer of metal or other electrically conductive material 16 and a second layer of metal or other electrically conductive material 18.

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The laminate 12 is electrically conductive, which enables the laminate to be used as a ground plane within the PWB, a power plane within a PWB or both a ground and power plane in the PWB where routing is used to electrically isolate portions of the laminate.

In addition, a printed wiring board is illustrated in FIG. 10, which includes two laminates 120 and 122 that act as a power and a ground plane (Pg. 22, lines 9 - 22). The specification explicitly teaches that the two laminates can be constructed similarly to the laminate 12 in FIG. 1 (Pg. 22, lines 18 - 19).

5. Electrical connections with the carbon containing layer

Applicants submit that the specification expressly teaches that electrical connections can be made with the "at least one carbon containing layer." As mentioned above, FIG. 10 illustrates a printed wiring board that includes two electrically conductive laminates constructed using layers containing carbon that act as functional layers within the printed wiring board. The specification teaches (Pg. 23, lines 8 - 10 and Pg. 25, lines 5 - 6):

The PWB 10''' also includes through holes 130 lined with electrically conductive material that are used to establish electrical connections between the functional layers in the PWB. Where connections between the plated through holes and the first or second laminates are not desired, then an annulus of dielectric material 132 such as an epoxy resin with a dielectric constant less than 6.0 at 1 MHz can be used to ensure that an electrical connection does not exist

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between the laminate and the electrically conductive lining of the through hole.

If a through hole does not pass through one of the filled clearance holes in a laminate, then the lining of the through hole is in electrical contact with the laminate.

Applicants submit that the use of the laminates including a layer containing carbon as a functional layer in a printed wiring board and the teaching of at least one technique for establishing an electrical connection between the laminates and other functional layers in the printed wiring board is an express teaching to one of ordinary skill in the art that electrical connections can be made either directly with an electronic device (i.e. using a plated through hole extending through the carbon containing layer and connecting to an electronic device) or indirectly (i.e. using a plated through hole extending through the carbon containing layer to create an electrical connection between the carbon containing layer and a circuit on another functional layer of the printed wiring board that is in turn electrically connected to an electronic device in a known fashion).

Conclusion with respect to general 35 U.S.C. §112 rejection

For the foregoing reasons, the specification clearly teaches the connection of electronic devices to circuits in a printed wiring board and that layers containing carbon can form part of the circuits in the printed wiring board. Therefore, there is an express teaching that "at least one connection exists between the

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carbon layer and the electronic device" and the rejection under 35 U.S.C. §112 incorrect.

Rejection of claim 70 under 35 U.S.C. §112

Applicants submit that throughout the specification the patterning of layers of metal with electric circuits is discussed. The term electric circuit is used interchangeably with the term circuit traces by those of ordinary skill in the art (see for example Pg. 7, lines 5 - 6). Therefore, patterning layers of electrically conducting material with circuit traces is both well known to those of ordinary skill in the art and described in the specification.

In response to the assertion that the use of the term "circuit trace" is unclear, Applicants profess confusion as to what alternative interpretation one of ordinary skill in the art could take other than that the "trace on the layer of electrically conductive material" is in fact one of the "circuit traces" patterned on the layer of electrically conductive material. Therefore, applicants submit that a rejection of claim 70 based on 35 U.S.C. §112 is incorrect.

Anticipation and obviousness

The Zweben et al. patent teaches that the layer containing carbon "must not interfere with the electrical properties or any other properties of the electronic components or other type of component in which it is ultimately utilized as a heat transfer device." The quoted passage highlights a key distinction between the claimed inventions and the Zweben et al. patent. The claimed inventions are to printed wiring boards where the "at least one layer containing carbon" is part of a circuit within the printed wiring board (i.e. "at least one electrical connection exists between the carbon containing layer and the electronic device"),

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whereas the Zweben et al. patent describes the use of a carbon containing layer as a heat sink that is isolated from the circuits on the printed wiring board. Indeed, the Office action acknowledges that the Zweben et al. reference does not teach the newly added limitations in claim 69, which are:

1. "at least one electrical connection exists between the carbon containing layer and the electronic device"; and
2. "wherein the electrical connection between the carbon containing layer and the electronic device includes a plated via extending through the carbon containing layer."

Applicants respectfully submit that neither the Zweben et al. patent nor any other cited reference teaches that "at least one electrical connection exists between the carbon containing layer and the electronic device" or the novel combinations claimed in the above referenced application. Therefore, all claims are patentable in light of the cited prior art references.

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Conclusion

Applicants submit that the specification teaches a printed wiring board on which an electronic device is mounted, comprising at least one carbon containing layer and wherein at least one electrical connection exists between the carbon containing layer and the electronic device. Applicants also submit that the prior art does not teach a printed wiring board possessing these features and, therefore, request the withdrawal of the final rejection and the allowance of all currently pending claims.

Respectfully submitted,
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